Resource curse

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Résumé

Are natural resources a blessing or a curse? As a matter of fact, few countries with abundant natural resources have succeeded in combining growth and development. What may account for this apparent paradox? Our analysis suggests that the institutional development of a country (at the time of the discovery of the natural resources) is the key factor explaining why a vicious or a virtuous circle of growth may develop. If the institutions are sufficiently well-established and strong enough to face predation behaviours, the country will then benefit from its substratum. On the other hand, insecure property rights (as is typical of countries with weaker institutions) will fuel predation behaviours around rent-production. To secure their property rights, firms will have no other option but to resort to corruption by transferring part of their rents into bribes, exceptional taxes, extortion racket, etc. The increase in these predation behaviours then limits the direct investment flow from foreign countries and blocks the country's development. This in turn will establish a climate of corruption in an economy with low production development.

In countries where natural resources are abundant, insecure property rights are thus detrimental in several ways. First, direct investment in the exploitation of resources is suboptimal. This has a proportional negative effect on the country's budget by lowering the tax revenue and limiting the country's development. The extraction potential, and thus the country's enrichment, is constrained by these insecure property rights. Besides, the climate of corruption, generated by the securing of these property rights, deters foreign investors from settling on the national market and locks the country in a poverty trap. The country only attracts firms belonging to sectors connected to natural resources and thus becomes dependent on the rate of raw materials and the exploitation of natural resources. When a state budget depends on exploitation rent at the expense of taxes on citizens, the democratic control of civil society is weakened and the convergence of the institutions towards an autocratic state is favoured, for lack of a strong system of checks and balances. In a moribund economy where investors (in particular foreign ones) are reluctant to value the country's potential, the inequalities generated by a corrupt government which grows richer through mining and oil revenues, and the empoverishment of the population, may result in political unrest leading to conflicts.

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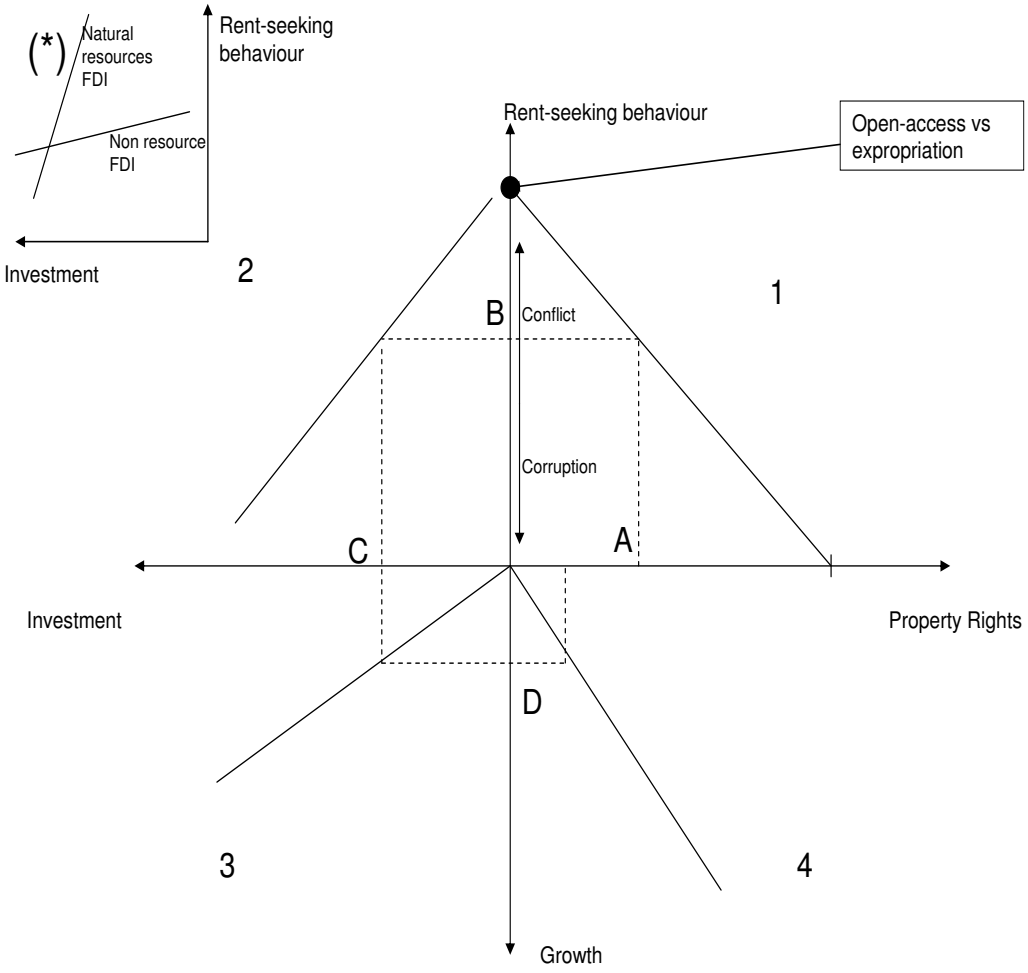
1 Facts

Economies with abundant natural resources tend to "grow slower than economies without substantial resources. For instance, growth losers, such as Nigeria, Zambia, Sierra Leone, Angola, Saudi Arabia and Venezuela, are all resource-rich, while the Asian tigers : Korea, Taiwan, Hong Kong and Singapore, are all resource-poor" (Mehlum et al 2006). On average, resource abundant countries lag behind countries with less resources. Sachs and Warner (2001) find out as well that countries "with high resource intensity tend to correlate with slow growth." Oil revenues per capita in Nigeria increased from US dollars 33 in 1965 to US dollars 325 in 2000, but income per capita remained the same, at around US dollars 1,100 in PPP terms, since its independence in 1960, putting Nigeria among the fifteen world's poorest countries. Between 1970 and 2000, the part of the population that has to survive on less than 1 dollar per day shot up from 26 to almost 70

Natural resources seems relevant to analyse conflicts as well. According to Ross (2002) "one of the most surpising and important findings is that natural resources play a key role in triggering, prolonging, and financing conflicts." For instance, countries such as Angola have been embroiled in conflicts for decades because of their abundant oil resources and some of the world's best diamonds. Indeed according to Collier and Hoeffler "income from natural resources predation such as diamonds in Angola, drugs in Columbia and timber in Cambodia" fuel conflicts. Their empirical analysis "confirms that countries with abundant natural resources have a higher risk of conflict". (Collier Hoeffler 2002) Ploeg agrees and explains that "economists demonstrate that resource revenues are prone to rent seeking and wastage." He adds that "country with no resources has a probability of civil conflict of merely 0.5%, but a country with a share of natural resources in GDP of a quarter has a probability of 23%. There is now a growing body of cross-country evidence that rents on resources and primary commodities, especially oil and other point-source resources, increase chances of civil conflicts and wars especially in sub-Saharan Africa through weakening of the state or financing of rebels." (Ploeg 2001)

2 Our interpretation of the resource curse



Our starting point is the idea that the quality of institutions, at the moment of the discovery of the natural resources, will determine the growth path of the country (diagram 1). In countries with high quality institutions, the predation behaviours will be lesser as the government, by keeping a monopoly on violence, restrains the agents' claims. On the other hand, in countries with low quality institutions, the agents, as they have leeway to put their claims forward, will try to capture part of the rent, at the expense of other individuals. In the extreme case of a "failed state" (near 0 in our graph), the country is very likely to fall into a cycle of violence. This explains why we support the idea that, in the case of a weak government in a country where natural resources are abundant, the analytical framework should be that of expropriation (because agents interact)

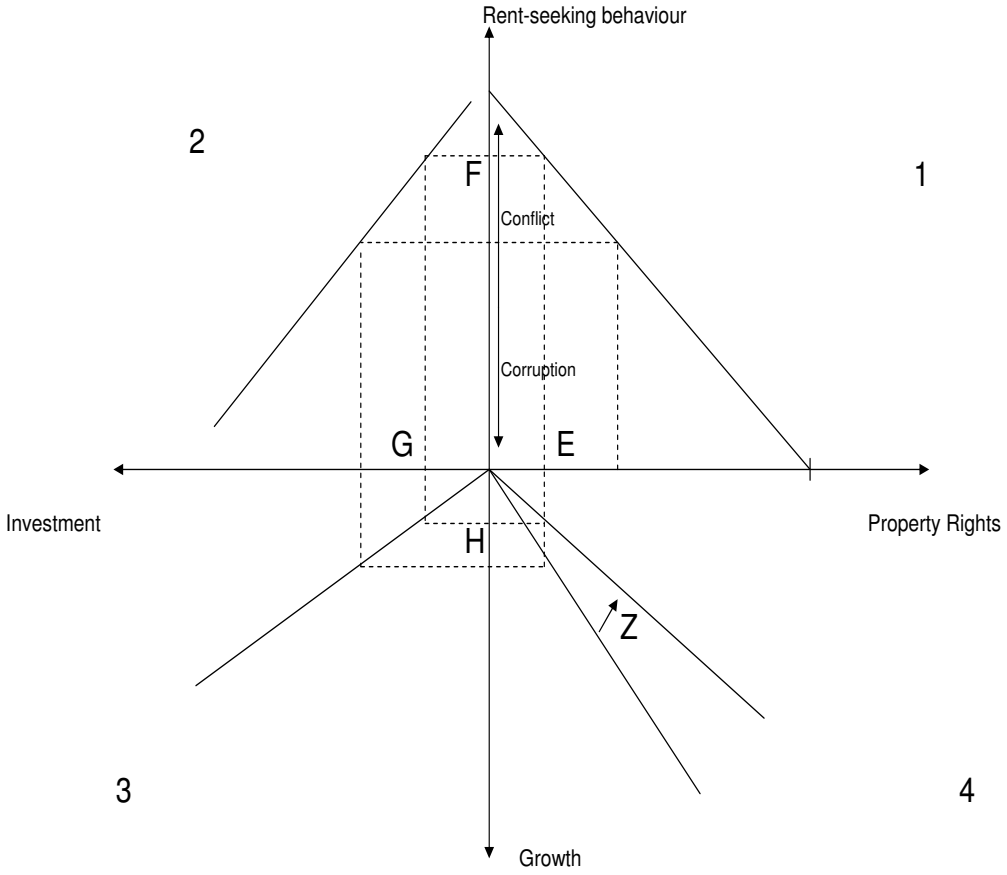
rather than "open access" (Skaperdas adn Syropoulos 2012) (see graph).

In this way, in a first model, we determine the threshold from which the quality of the institutions allows (or not) for the predation behaviours to develop. In the case where the quality of institutions is too low, a balance of predation is reached ; and in the opposite situation, a balance of production.

The importance of predation behaviours will have an impact on the country's level of local and foreign investment (diagram 2). However, the effect is not the same depending on whether these investments aim at getting at natural resources or the productive sector. As we shall see, the elasticity of investment to predation behaviours is much more significant in the case of "non-resource FDI" than "resources FDI" (see diagram *).

In a second model, we study the case of firms which invest in natural resources in a country where property rights are not secured. We then model the arbitrage between corruption and investment and show that the level of corruption is all the more so high as resources are plentiful and the market structure little competitive.

Consequently, the more the country allows for predation behaviours, the more it becomes dependent on resources, the productive sector being little encouraged to develop. The decrease in the investment level then weakens the country's potential for growth (diagram 3). The country is thus more subjected to the price volatility of raw materials, which has a potentially negative impact on its growth level. This relatively low and unstable growth limits the taxation level on the productive sector (which is not developed enough) and makes the state budget depend on the extraction of resources. At the budget level, the state depends on the population's income, which weakens democractic control and reinforces the governing power. This concentration of powers thus undermines the quality of the country's institutions and the securing of property rights (diagram 4).



Hence (starting from point E), corruption is stronger and more widespread since property rights are less protected. The country's low growth, originating from the low development of the productive sector, and the rise in inequalities, may fuel resentment in part of the population which may try to obtain, sometimes in outbursts of violence, a better sharing of the rent (F). If the government has a good control over the country's natural resources (which fund the state budget), it will be able to finance a status quo by enforcing repressive measures (see Z on diagram 4). If not, the country is likely to fall into a spiral of violence.

3 Theories of the resource curse

There are different theories explaining the resource curse.

3.1 Dutch disease

The first one (historically speaking) is to know whether a natural resources windfall increases the real exchange rate leading (or not) to a contraction of the tradable sector (Dutch Disease). Effects of a resource boom impact mainly on the non-resource traded goods sector. First, increased disposable income will be partly spent on non-traded goods sector causing prices in these sectors to rise. To restore equilibrium in the labor and nontraded goods market, the real exchange rate has to rise and real wages in the non-traded goods sector have to fall. This, in turn, reduces the competitiveness of the traded non-resource goods sector. More recent research suggests, however, that Dutch disease is less common in developing states than originally thought, and that governments can usually offset its impact (Ross 1999).

3.2 Volatilily

Ploeg and Poelhekke (Ploeg, Poelhekke 2009) put instead the emphasis on the volatility of the natural resource. Changes in natural resource wealth are triggered by sudden changes in commodity prices or resource discoveries, which can lead to boom and bust cycles. Resource revenues are highly volatile because their supply exhibit a low price elasticity (Ploeg 2011). Indeed, according to the authors "countries that specialize in commodities with substantial price volatility have more volatility in their terms of trade, enjoy less foreign direct investment and experience lower growth rates than countries that specialize in commodities with more stable prices." Thus the positive effect of resources on growth is swamped by the indirect negative effect through volatility.

3.3 Rent-seeking behaviour

Rent-seeking behaviour (the voracity effect) is a more current way, in the literature, to explain the resource curse. We assume two types of rent-seeking behaviour depending on the motives of agents : A rapacious rent-seeking behaviour and a grievance rent-seeking type. In the rapacious rent-seeking behaviour we wish to make a distinction between the ways the rent is taken : through violence (conflicts) or through corruption.

3.3.1 Rent-seeking behaviour and conflicts

The economic literature sees conflicts as an opportunity (Azam *et al 2001*). Rebellions are modelled as an industry that generates profits from looting, "greed is thus the main motivation factor". In this context "state control is best regarded as the art of deterring entry into the extortion business. The government typically seeks to defend its monopoly power over the extraction of natural resources from the population by coercion, while rebellion is precisely a challenge by a contender entering this market with a view to carve a slice of this pie." The seminal paper on the rental seeking behaviour paper is that of Collier and

Hoeffler (Collier, Hoeffler 2002). They wonder if conflicts are due to greed behaviour or a feeling of grievance. They find little evidence for grievances as a determinant of conflict. Rent seeking behaviour, on the contrary, seems more convincing to explain why conflicts may emerge or not. Consequently, countries which own natural resources are more likely to experience civil wars because rent seeking behaviour is stronger. In the paper On Economic Cause of Civil War (Collier, Hoeffler 1998) the authors find indeed that natural resources increase the probability of civil war onset. Rebels are assuming doing a trade-off between the potential gains from waging war (gaining control of the state) compared to losses (disruption of the economic activity for instance). The more natural resources the country has the more interesting it is for rebels to fight to capture the state. Indeed, natural resources increase the price value of capturing the state (Fearon Laitin 2003). However, when natural resources wealth is very high the authors assume that the state can defend itself by increasing the potential rebels' losses (the relationship between natural resources and conflicts is thus non monotonic). Lujala confirms, through his empirical test, Collier and Hoeffler's results that natural resources provide a motivation for rebels to rise up. "Greedy rebels may use conflict to satisfy their material aspirations".

Natural resources are thus a motive for people to wage war. In the extractive regions we may see criminal gangs, warlords or rogue military officers acting to get a fraction of the rent.

Hodler (2004) finds out that natural resources "and other windfall gains" lead to an increase in fighting activities if there are multiple rivalling groups. Thus natural resources are a curse when there are "many rivalling groups".

3.3.2 Rent-seeking behaviour and corruption

According to Leite and Weidmann "issues of corruption may be particularly relevant in the context of natural resource abundance, as natural resource exploration is an extremely high rent activity likely to foster rent-seeking behaviour"(Leite, Weidmann 1999) The authors, through a theoretical and empirical investigation, highlight that natural resources foster rent-seeking activities. Pedro and Vicente (Pedro and Vicente 2010) compare the aftermaths of an oil discovery in Sao Tomé in 1997 and 1999 comparing it with what had happened in Cape Verde (which did not discover oil). Both countries have "similar histories, culture, and political institutions". The authors find that corruption increased by 10 % after the discovery of oil in Sao Tomé. The corruption type of rent-seeking can be divided into three types of rent-seeking behaviour. The first one referred to as "rent creation", are agents seeking rents created by the states by bribing politicians and bureaucrats. "Rent extraction" implies politicians and bureaucrats seek rents held by agents, by "threatening firms with costly regulations." The last one, "rent seizing" occurs "when state actors seek rents that are held by state institutions. (Ross 2001) For instance, according to Ades and Di Tella (Ades and Di Tella 1999) corruption may actually come from bureaucrats. They find out, after a cross-section analysis, that countries where firms have a high level of rent (such as natural resources extractive firms) tend to have higher corruption levels. They find thus that "corruption is higher in countries where domestic firms are sheltered from foreign competition" and with economies dominated by a small number of firms.

3.3.3 Rent-seeking behaviour and grievance

"Not surprisingly, people are more likely to rise up against their government when their economic predicament is bad and getting worse. Rebel groups find it easier to recruit new members when there is widespread poverty and unemployment (since it makes the prospect of combat and looting seem more attractive by comparison)" (Ross 2002). The grievance type of rent-seeking is due to the perception by agents of inequalities or income impoverishment. People may have the feeling of being stolen thus fuelling tensions and causing conflicts. People are more likely to rise up when their economic situation is getting worse and when they have the feeling that only a fraction of the population benefit from natural resources. For instance in Indonesia (Ross 2002) the most important reason for discontent in the Aceh region "was the belief that jobs and the revenues from natural gas were not being adequately shared." Consequently separatist movements became popular waging war in that region (in order to get access to the rent of the natural resources). The Heinrich Böll Stiftung reports some uprising movement against extractive industries. In 1989 for instance the owner of copper and gold mines in Papua New Guinea refused the demands for compensation brought by the inhabitants of the island of Bougainville leading to acts of sabotage from the locals. In Niger, the insurgent stressed that the north received little investment from the political center (in the south) in spite of the fact that the south relied economically on revenues gained from the uranium wealth of the north (Humphreys 2005). Extractive industries are thus embroiled in conflicts more often than other sectors. Resources are location-dependent and are often found in remote regions, forming an "island of wealth" surrounded by poverty. Companies can thus worsen conflicts by widening existing social inequalities, by ignoring the concerns of local communities or by supporting authoritarian regimes to safeguard their own interests.

4 The role of institutions

4.1 Why are natural resources a blessing in Botswana ?

Acemoglu and Robinson (Acemoglu, Robinson 2001) suggest that Botswana did not experiment a resource curse in spite of its mineral resources, because "good institutions" (meaning "institutions of private property") were in place when diamonds where first discovered. The authors analyse the strength and the type of institutions in the country before, during and after colonisation. They find out pre-colonial institutions were strong and not much altered by British colonialism. Following independence, the elite maintained and strengthened institutions of private property and, when diamonds were discovered the State was strong enough to guarantee an equal repartition. According to the authors, a good institution implies, that institutions provide secure property rights and that "a broad cross-section of the society" has the opportunity to invest in that resource. Botswana experiences a resource bless because of good institutions which foster investment, economic development and growth.

Thus "weak institutions may explain poor performance of oil-rich states such as Angola, Nigeria, Sudan, and Venezuela, diamond rich Sierra Leone, Liberia, and Congo, and drug states Colombia and Afghanistan. These institutions are often destroyed by civil wars over control of resources" (Ploeg 2011).

4.2 Institutions versus rent-seeking

Why should there be corruption rather than conflict ? We may assume that this distinction is due to the relative strength and type of institutions in the countries where natural resources are discovered. As Collier and Hoeffler find out, the link between natural resources and conflicts is non-linear : when the country as a lot of natural resources the state can defend itself, and prevent conflicts (through wealth coming from extraction) which is not the case when the level of natural resources is low. We may assume that when the state is weak, conflicts are more likely to occur than when the state is strong and non-democratic. In the latter case corruption may expand (see below). As Mehlum *et al* (2005) explain, "resource rents may be channelled into the productive economy, or they may be captured by the elite for personal enrichment. Whether the rents stimulate the productive economy or induce strategic jockeying among the elites, depends on the quality of institutions". The authors add that "dysfunctional democracies invite political rent appropriation ; low transparency invites bureaucratic corruption ; weak protection of property rights invite shady dealings, unfair takeovers and expropriation ; weak protection of citizens' rights invite fraud and venal practices ; weak rule of law invites crime, extortions, and mafia ac- tivities ; a weak state invites warlordism".

We will thus define "good institutions" as institutions which guarantee private property, "so that those with productive opportunities expect to receive returns from their investments"(Acemoglu *et al* (2001)).

4.3 Type of resources and rent-seeking behaviour

Not all types of resources have the same effects on the economy. Some natural resources, which are very valuable, fuel rent-seeking behaviour, much more than others. Consequently, the quality of institutions has to be much stronger in order to avoid predatory behaviour.

Murshed shows that it is not the natural resources "endowment per se but its type" that matters. Indeed some natural resources, such as oil and minerals, have concentrated incomes, while other types of natural resources, such as agriculture, have diffuse revenues. We thus make a distinction between a point-source economies and diffuse natural resources. Ross (Ross 2002) agrees with Murshed when he says that natural resources that cause problems are largely "oil and har-rock minerals (including oil, gold, diamonds and other gemstones)".

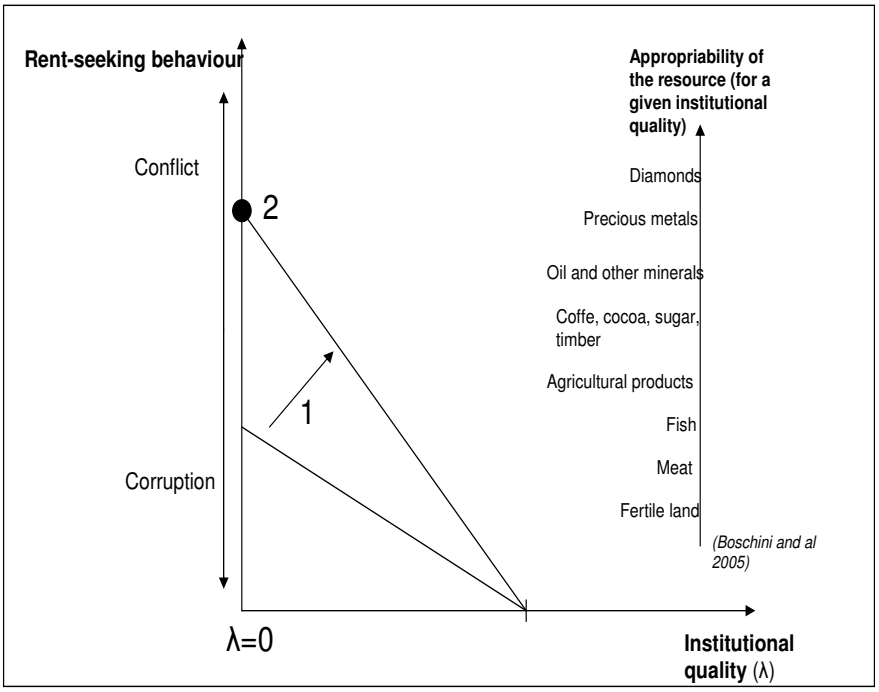
Boschini Pettersson and Roine (Boschini and al. 2005) are more specific about natural resources. They prove that the resource curse depends on the interaction between the type of resources that a country possesses and the quality of its institutions. Indeed this combination of factors determines what they call the "appropriability of a resource". Thus, for a given quality of institutions, some resources are defined as "appropriable" because they are "very valuable, can be stored, easily transported, and easily sold." Consequently countries where resources are highly "appropriable" resource abundance is problematic because rent-seeking is high. The institutional thus quality has to be very strong to limit these "voracious behaviours". When resources are less appropriable, they can contribute to economic growth. "[T]his suggest that resources such as diamonds or precious metals are more problematic than, say, agricultural products."

We could add, with Lujala, that the location of the resource is important as

well : “onshore oil production increases the risk of conflict onset by 50% while offshore production has no effect”. These results make us think that resources location is important to give rebels an opportunity, or not, to rise up.

4.4 To sum up

In our framework, what is important is thus the strength of the institutions at the time when natural resources are first discovered. If the institutional quality is weak, rent-seeking behaviour will be very high. On the contrary, when the institutional quality is strong, rent-seeking behaviour becomes lower. That is why we assume a negative relation between institutional quality and rent-seeking behaviour (see graph). As we explained earlier, when natural resources are appropriable, rapacious behaviour are stronger. That is why we assume that the slope of the curb depends on the type of natural resources. When natural resources are very valuable, rent-seeking increases (1) and the slope is higher. We follow Boschini *et al* (2005) and order natural resources depending on their "appropriability" (for a given institutional quality). The more appropriable they are, the more rent-seekers will react.



4.4.1 Open access versus expropriation

What happens when $\lambda = 0$? In other words when there is no private property ? Are we in an open access framework or in an expropriation framework ? (see 2 on the graph)

The literature onenvironmental and natural resource "focuses mainly on problems of market failure" (Anderson, Libecap 2005). Accordingly, natural resources and environmental goods are either over exploited as a result of the tragedy of the commons, or under produced as a result of the free rider problem. Consequently natural resources with unrestricted entry lead to "rapid depletion, no investment or conservation, and limited trade."

According to Skaperdas and Syropoulos (2012) "overwhelming attention has

been indulged on the over-exploitation problems of open-access resources and the tragedy of the commons problems." They think that the effects of distributional conflict may be more relevant to analyse effects of weak property rights. They identify harmful effects of insecure property. Indeed insecure property rights can lead to conflicts. In their model "the relative quantities of guns chosen by the two agents determine the probability of each agent winning the entire resource."

5 Rent-seeking versus production : the key role of institutional quality

We build a model aiming at showing the key role of institutions in rent seeking. Indeed, according to Chakraborty and Dabla-Norris (2006) in an economy with no property rights protection wealthy people might behave as rent-seekers. "In many developing and transition countries, it is the relatively wealthy who choose rent-seeking activities – such as the government bureaucracy, the army, and the police – rather than engaging in productive and entrepreneurial activities." That is because in their model rent seeking is a costly activity (like purchasing weapons for instance) and the rich people, who have more to lose from expropriation, have more incentive to engage in rent seeking activities. "Societies that have a more unequal distribution of wealth and are characterised by a small fraction of people who can afford entry into rent seeking will be the societies with greater social polarization and entrenched rent seeking by a few at the expense of the majority."

We assume two types of people, the grabbers (denoted b) and the producers (denoted p). There is in the economy a natural resource R.

Depending on the strength of institutions (λ) grabbers will expropriate producers or not. The weaker the State, the higher the grabbers' income (coming from R), and consequently the lower the producers' income.

5.0.2 Entrepreneurs

We assume N entrepreneurs with N = $n_g + n_p$.
n_g corresponds to the number of grabbers in the economy
and α the proportion of grabbers (n_g/N)
We assume that grabbers target rents from natural resources R and use all their capacity to appropriate as much as possible of this rent.
n_p is the number of producers in the economy.
(1-α) the proportion of producers (n_p/N).

5.0.3 Institutions

We denoteλ as the quality of institutions.
We assume that when institutions are weak grabbers expropriate resources from other agents. When the quality of institutions is high the rent-seeking behaviour is lower.

5.0.4 Expropriation

s(λ) denotes the level of expropriation.
R is the amount of natural resources in the economy.
When institutional quality is significant
all N entrepreneurs get the same amount of resource $\frac{R}{N}$
When the institutional quality is weak,
only grabbers get access to the resource,
they extract the entire rent,
and each grabber gets $\frac{R}{n_g}$

We assume N = 1.

We denote Π_g the grabbers' profit :

$$\Pi_g = (1 + s(\lambda))R \tag{1}$$

Thus, when the quality of institutions is good, grabber' profit tends to be equal to R/N. On the contrary, when the quality of institutions is bad, grabbers expropriate other entrepreneurs and their profit increases as s increases.

Consequently producers get (Π_p^R) :

R = α(1+s)R+(1-α)Π_p^R

$$\Pi_p^R = R\frac{1-\alpha(1+s)}{1-\alpha} \tag{2}$$

5.0.5 Monopolistic competition

We assume a monopolistic competition between producers in the economy. Indeed, the economy we describe corresponds mostly to economies from the South (rich in natural resources with grabbers stealing the rent). In those economies activities are mainly retail markets ("vente au détails") where small firms try to differenciate their production. According to Petroff (2002) monopolistic competition is relevant to describe that kind of market.

The cost function is equal to :

$$CT(q_i) = cq_i + F \tag{3}$$

With q_i production of the firm i, and F the fixed cost

We assume a classical demand function

$$q_i(p_i) = S(\frac{1}{1-\alpha} - \beta(p_i - p)) \tag{4}$$

With S total sells in the industry.
p_i price of variety i produced by i
p is the average price
β is the degree of product differenciation, $\beta > 0$.

$$\Pi_p^p = p_i(\frac{1}{1-\alpha} - \beta(p_i - p)) - c\frac{1}{1-\alpha} - \beta(p_i - p) - F \tag{5}$$

With Π_p^p the profit function of producers
(without taking into account incomes coming from natural resources)

Profit maximisation gives us :

$$\Pi_p^{p\prime} = -2\beta p_i + \beta p + c\beta + \frac{1}{1-\alpha} = 0 \tag{6}$$

As all firms are similar we get p_i = p
Thus

$$p = \frac{1}{\beta(1-\alpha)} + c \tag{7}$$

Then

$$\Pi_p^p = \frac{1}{\beta(1-\alpha)^2} - F \tag{8}$$

5.0.6 Grabbing vs Production

The two profits function are thus :
$\Pi_p = \frac{1}{\beta(1-\alpha)^2} - F + R\frac{1-\alpha(1+s)}{1-\alpha}$
$\Pi_g = (1+s)R$

When α increases Π_p increases as well :

$$\Pi_p^{'} = \frac{1}{(1-\alpha)^2}(Rs + \frac{2}{\beta(1-\alpha)}) > 0 \tag{9}$$

Equilibrium :
Let's calculate now α^*, the proportion of grabbers in the economy.

$$\Pi_g = \Pi_p <=> \frac{1}{\beta(1-\alpha)^2} - F + R\frac{1-\alpha(1+s)}{1-\alpha} = (1+s)R \tag{10}$$

$$-F\alpha^2 + (2F + Rs)\alpha + (\frac{1}{\beta} - F - Rs) = 0 \tag{11}$$

Let's calculate now the discriminant

$$\Delta = (2F + Rs)^2 + 4F(\frac{1}{\beta} - F - Rs) \tag{12}$$

$$(Rs)^2 + \frac{4F}{\beta} > 0 \tag{13}$$

The discriminant is positive.

$$\alpha_1 = \frac{2F + Rs + (R^2s^2 + \frac{4F}{\beta})^{\frac{1}{2}}}{2F} \tag{14}$$

$$\alpha_2 = \frac{2F + Rs - (R^2s^2 + \frac{4F}{\beta})^{\frac{1}{2}}}{2F} \tag{15}$$

We look for which conditions α_2 belongs to [0,1]
$\alpha_2 > 0$

$$2F + Rs > (R^2s^2 + \frac{4F}{\beta})^{\frac{1}{2}} \tag{16}$$

$$F + Rs > \frac{1}{\beta} \tag{17}$$

$\alpha_2 < 1$

$$Rs < (R^2s^2 + \frac{4F}{\beta})^{\frac{1}{2}} \tag{18}$$

$$\frac{4F}{\beta} > 0 \tag{19}$$

Which is always true if F or β non equal to zero.

Then

$$\alpha^* = \frac{2F + Rs - (R^2 s^2 + \frac{4F}{\beta})^{\frac{1}{2}}}{2F} \tag{20}$$

We calculate now λ^*,
the level of institutional quality when there are no grabbers.
In other words :

$$\alpha = 0 <=> F + Rs = \frac{1}{\beta} \tag{21}$$

$$s = \frac{\frac{1}{\beta} - F}{R} \tag{22}$$

We assume that when institutional quality becomes lower the amount of expropriation increases but less than proportionally. We assume that the more grabbers there are in the economy the less important is the increase of s is, as grabbers may interact among them.

We thus assume that

$$s = \lambda^{\gamma} with, 0 < \gamma < 1 \tag{23}$$

Consequently,

$$\lambda^* = (\frac{\frac{1}{\beta} - F}{R})^{\frac{1}{\gamma}} \tag{24}$$

5.0.7 Comments

We see thus that the higher the amount of natural resources the lower λ^*. This result is the one expected, institutional quality has to be very strong when natural resources are very valuable.

When the fixed cost F increases the threshold λ^* decreases. As the productive sector becomes less easier to enter (as the fixed cost is relatively high) the trade-off between grabbing and producing is less favorable for productive activities. Thus a production equilibrium requires a high quality of institutions.

Indeed when competition tends to increase (β tends to be equal to 1) the rent of monopoly is lower and productive activities are relatively less interesting. When β increases λ^* decreases.

There are thus two equilibria :

Production equilibrium : where all entrepreneurs are producers, that is the case when :

$$\lambda < \lambda^* \tag{25}$$

Grabber equilibrium : where some entrepreneurs are producers and some are grabbers, when

$$\lambda > \lambda^* \tag{26}$$

6 Why corruption ?

6.1 Insecure property rights and corruption

We assume that in countries having insecure property rights (a low institutional quality) and capital intensive resources firms will have to corrupt the rent-seeker to secure their foreign investments. Indeed, in Grossman (Grossman 2001) insecure property rights compel agents to do a trade-off between production and securisation of their properties. In Grossman's model agents having an initial claim on certain resources in an insecure environment "must choose how to allocate time and effort among appropriative activities and production".

Lambsorff highlights several causes of corruption. The more relevant ones are explained through natural resources, weak institutions and lack of competition. In our framework we consider, in a first step, that there is corruption (rent-seeking behaviour) only if the institutional quality is weak (in a natural resource rich country). Then, the lack of competition and the amount of natural resources will then, determine how high the level of corruption will be. The higher the amount of natural resources is the higher the amount of corruption will be. Similarly, we assume that the competitiveness of the market structure will determine the level of firms' rent and will consequently "reduce the motive (or not) of public servants and politicians to seize parts of these rents by means of extortion and corruption" (Lambsorff). Ades and Di Tella (1999), with an empirical study of the causes of corruption across countries, examine the hypothesis that the level of rents 'in general, and market structure in particular," determine the level of corruption in the economy or not. In a cross-section analysis they find that countries where firms enjoy higher rents tend to have higher corruption levels. They find that the level of corruption is higher when the market structure tends to be oligopolistic and is lower when the market structure tends to be competitive.

6.2 Aftermaths

According to Deaton (Deaton 1997) insecure property rights hinder resource extraction because they hinder FDI and thus investment "both in resource discovery and in the capital equipment needed for extraction." Thus, the stocks of "capital intensive resources should tend to remain largely unexploited in poor countries, because the lack of ownership that causes their poverty also hampers accumulation of capital needed for stock extraction." However this effect is true only if the extraction of the resource is capital intensive. When the extraction of the resource is labor intensive (with insecure property rights) extraction is actually relatively quick. Ross (Ross 1999) explains that when property rights are unsecured manufactured firms find it difficult to invest "since the risk of lost investments cannot be offset by normal profit margins". However resource extraction can still proceed if the rent is high enough to pay "criminal gangs, private militias, or nascent rebel armies for the private enforcement of their property rights." Ploeg and Poelhekke (2010) show that institutional quality does have a positive effect on resource FDI and that when property rights are secured the flow of FDI increases. According to Asiedu the empirical results indicate that countries that are endowed with natural resources will attract more resource FDI when there is in the country an efficient legal system, no

corruption and a political stability. "Good institutions, namely, less corruption and a reliable legal framework have a positive impact on FDI." Consequently, bad institutions and weak property rights will lower the level of FDI in natural resources. However, as natural resources are specific assets, those firms invest in the country (in spite of corruption) and allow corruption to spread out.

7 Corruption vs FDI

We assume that institutional quality is the key determinant to explain how strong the rent-seeking behaviour will be in a country. When institutional quality is low property rights are insecured. However, insecure property rights refrain foreign investors from investing in extractive industries (when the industry is capital intensive, Deaton). We assume then that foreign investors (in natural resources) have to corrupt to secure their properties. However the less they have to corrupt, the less they will invest.

7.0.1 Notation

We consider n identical entrepreneurs denoted i belonging to [1,n].
Let's note W_0 as the initial level of resource found in a country.
We then note j_i as the level of FDI.
We assume that each entrepreneur buys prospection rights in order to discover new deposits. We denote k the price of one prospection right.

The stock of natural resources exploited in a country depends on the level of total FDI coming from entrepreneurs.
The higher j_i the higher the level of natural resources exploited will be.
We then note :

$$W_0(1 - e^{-\sum_{i=1}^{n} j_i}) \tag{27}$$

b_i is the level of corruption of the firm i. P corresponds to property rights. We assume that the institutional quality of the country is relatively weak compelling firms to corrupt in order to secure their property rights. We assume that P depends on the level of corruption given by one firm relatively to the average amount of corruption in the economy ($\sum_{k=0}^{n} b_k$). The higher the level of b_i is (compared to $\sum_{k=0}^{n} b_k$) the more secured property rights are.

Thus, $P = \frac{b_i}{\sum_{k=1}^{n} b_k}$

"a" is the price of corruption.

Firms have to corrupt in order to secure their property rights.
There is then a trade-off between corruption and Investment.

Maximisation :

We then maximise F relatively to b_i and j_i

$$Max_{bi,ji} F = W_0 \frac{b_i}{\sum_{k=1}^{n} b_k}(1 - e^{-\sum_{i=1}^{n} j_i}) - ab_i - kj_i \tag{28}$$

FOC is :

$$F'_{b_i} = \frac{W_0}{(\sum_{k=1}^{n} b_k)^2}(\sum_{k=1}^{n} b_k(1 - e^{-\sum_{i=1}^{n} j_i}) - (1 - e^{-\sum_{i=1}^{n} j_i})b_i) - a = 0 \tag{29}$$

We assume that all firms are similar, thus $b_i = b$ and $ji = j$

Hence,

$$F'_{b_i} = ((1 - e^{-\sum_{i=1}^{n} j_i})(\sum_{k=1}^{n} b_k - b_i)\frac{W_0}{(\sum_{k=1}^{n} b_k)^2} - a = 0 \tag{30}$$

$$(1 - e^{-\sum_{i=1}^{n} j_i})(n-1)b\frac{W_0}{n^2 b^2} = a \tag{31}$$

$$b = \frac{W_0(1 - e^{-\sum_{i=1}^{n} j_i})(n-1)}{n^2 a} \tag{32}$$

Let's now calculate j_i

$$F'_{j_i} = W_0(e^{-\sum_{i=1}^{n} j_i})\frac{1}{n} - k = 0 \tag{33}$$

$$-\sum_{i=1}^{n} j_i = ln(\frac{nk}{W_0}) \tag{34}$$

We thus get,

$$j^* = -\frac{1}{n} ln(\frac{nk}{W_0}) \tag{35}$$

$$b^* = \frac{(W_0 - nk)(n-1)}{n^2 a} \tag{36}$$

7.1 Comments

We thus see that there is an investment only if the level of the initial amount of natural resources is high enough. Indeed,

$$ln(\frac{nk}{W_0}) < 0 \tag{37}$$

$$\frac{nk}{W_0} < 1 \tag{38}$$

$$nk < W_0 \tag{39}$$

W_0 has to be high enough (superior to nk : the number of investors multipied by the price of prospection rights). So, the value of natural resources has to be higher than the total cost of investment.

As expected, in a country where property rights are insecured (when institutions are weak), and when firms have to corrupt to secure their property rights, corruption is a growing function of the amount of natural resources. Furthermore, the more competitive the market structure is (when n increases) the lower the amount of corruption will be (b^* decreases).

Thus when the country is resource rich we expect a higher level of corruption. However, the higher the level the corruption is the lesser non-resource investors will be. That is because investment and FDI are very sensitive to corruption.

7.2 Corruption and Investment

Bénassy-Quéré *et al* (2007) explain that, due to sunk costs, FDI is "vulnerable to any form of uncertainty" such as the payment or not of corruption. They show indeed that "bureaucracy, corruption and legal institutions" are important determinants of inward FDI. Lambsdorff (1999), quoting the World Bank, distinguishes different types of corruption. The first one is one "where you pay the regular price and you get what you want". The second one is one "where you pay what you have agreed to pay and you go home and lie awake every night worrying whether you will get it or if somebody is going to blackmail you instead." Thus, countries having a more predictable corruption have a higher investment rate compared to other corrupt countries (World Development Report (1997)). Others find out as well that different forms of corruption have different effects on FDI. While corruption deters FDI from entering the country, in the field of import/export permits it has a positive impact on FDI inflows. Corruption in the field of annual tax payments, access to public utilities and judicial decisions is a strong deterrent against FDI. Lambsdorff thus shows that FDI is very sensitive to the level of corruption. In a cross-section of 65 countries corruption is shown to decrease capital inflows at a 99% confidence level. According to his study if Colombia's level of integrity were to increase to that of the United Kingdom, the net annual capital inflows would increase by 3 percent of GDP. Wei (1997) highlights that an increase in "the corruption level from Singapore to that of Mexico is equivalent to raising the tax rate by over twenty percentage points." Asiedu finds out as well that corruption ranks very high on the list of obstacles to FDI. Habib and Zurawicki suggest as well that corruption hampers FDI. Foreign investors may limit corruption "because they believe it is morally wrong". They may also try to avoid corruption because it can be "difficult to manage, risky, and costly". In addition, their study shows that the difference in the level of corruption between the home and the host countries also explains the negative effect of corruption on FDI.

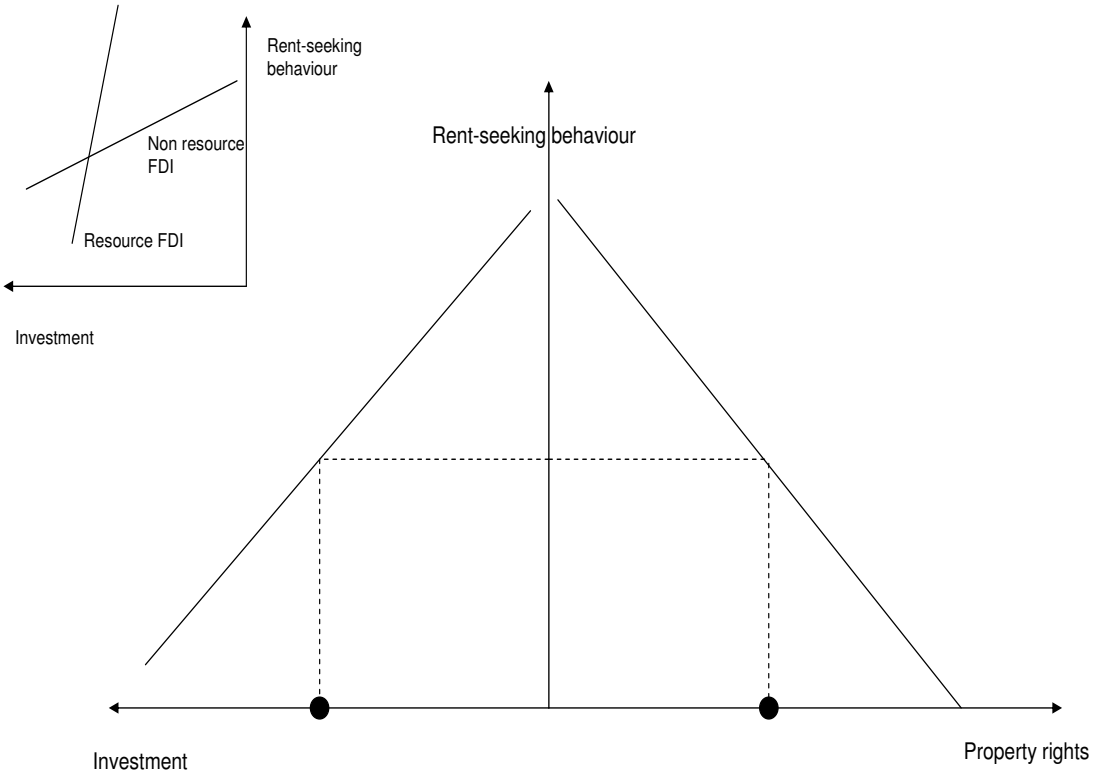
The seminal paper of Mauro (1995) on corruption shows that bribes have a significant effect on the level of investment in a country. His paper provides evidence that corruption may have "considerable adverse effects on economic performance". Indeed, in a sample of 67 countries, corruption negatively impacts on the ratio of investments to GDP. He claims that "if Bangladesh were to improve the integrity of its bureaucracy to the level of that Uruguay, its investment rate would increase by almost five per cent of GDP". Similarly, the same result was obtained by Keefer and Knack (1995), who incorporated cor-

ruption among other explanatory variables into one single index of "institutional quality".

7.3 A dependency on natural resources

Consequently, the country attracts only resources FDI. Indeed, FDI, in resource rich countries, are often the main flow of foreign investment in the country. In the case of Africa, for instance, we know that the flow of FDI is mainly explained through natural resources (Asiedu 2010). According to the OECD "75 % of FDI in Africa in the period 1985-1991 was concentrated in the mining and oil extraction industries." Furthermore over the forty years to 1993 Africa's share by value of world mining output declined from 23% to 10%." In another report, focusing on Congo Kinshasa, the OECD highlights that natural resources are far from being fully exploited. Besides, corruption, caused by natural resources, hinders investment and FDI to expand and then limits the potential growth of the country. (OECD 2008) We thus see, with those examples, several important results concerning resource rich countries. First, FDI in natural resources, are often one of the main flows of foreign invesment in the country. Second, the potential of extraction of natural resources is not always at its maximum.

Consequently in a rich natural resources country with insecure property rights extractive firms have to corrupt to secure their properties. Corruption, fuelled by natural resources, will hamper foreign investors to settle in the country. FDI and local investment will diminish, letting the country in a poverty trap.



We represent this idea on a graph. Resource FDI and non-resource FDI do not have the same sensitivity to rent-seeking. As shown the higher rent-seeking is (because of weak institutions) the less non-resource investments will occur. That is also true for resource FDI (when it is capital intensive) but at a lower extent. That is why slops are not the same on the upper graph. Consequently, when rent-seeking remains very high, the country attracts only resource FDI.

7.4 Institutions and conflicts

We see conflict as an extreme case of a low level of institutional quality. When property rights are weak, (meaning that the State is nearly inexistent ("failed State")), natural resources may lead to conflict has no one as "the monopoly of power." People struggle to get access to the rent. Highly valuable resources "open the door for criminal gangs, and rogue military officers, who may eventually grow strong enough to challenge the government". (Ross 2002) According to Ross (Ross 1999) weak institution may explain poor performance of oil-rich states such as Angola, Nigeria, Sudan, and Venezuela, diamond rich Sierra Leone, Liberia, and Congo, and drug states Colombia and Afghanistan. There institutions are often destroyed by civil wars over control of resources. Hodler (2004) put the emphasis on the risk of having natural resources in fractionalised countries. Indeed the more divides the country is the higher the risk of conflict.

8 Resource curse and poverty trap

Thus, when the State is too weak to cope with rent-seeking behaviour the country turns to violence and conflicts (such as Sierra Leone, the Democratic Republic of Congo etc). Conflicts around natural resources tend to last longer than other types of conflicts.

8.1 Repression

Otherwise, when the State is strong enough to take over natural resources, and when the state is non-democratic (Ploeg 2011) corruption may flourish. Indeed, when the State is democratic, property rights are secured as the law limits government power. From 1980 to 2004 natural resources are proven to induce corruption in nondemocratic regimes by Sambit, Bhattacharyya and Hodler (Sambit *et al.* 2010). "Democratization may thus be a powerful instrument to curb corruption in resource rich countries." Murshed finds out that "a point-source type natural resource endowment does retard democratic and institutional development, which in turn hampers economic growth." "Resource dependence elicits corruption and rent seeking via protection, exclusive licenses to exploit and export resources by the political elite, oligarchs and their cronies to capture wealth and political power". (Ploeg 2011)

When governments are strong enough to secure and perceive revenues from natural resources "they tend to use it to quell dissent, by building up their domestic security forces. Oil and mineral-rich governments generally spend unusually large sums on their military forces." (Ross 2002) This effect is what Isham *et al.* (2004) name the "rentier effects". When the revenues can be extracted easily, the government needs less taxation. Consequently citizens put less pressure on the government to safeguard good governance. The state has resources to buy off critics and pursue direct repression and violence against dissenters. By the same token, citizens have less incentive to create mechanisms of accountability and develop the "deep civil society and horizontal social associations [...] preconditions of democracy". Natural resources "strengthen states", "weaken societies" and fuel corruption.

8.2 State Weakeness

Fearon and Laitin (Fearon, Laitin 2003) argue in the same way when they explain that natural resources weaken the state because it has lower incentives to create a strong bureaucratic institution. For instance, oil-states are more likely to have weak structures because they need a less intrusive bureaucracy to raise revenue. "The result may be a state such a Mobutu's Zaire that is divorced from the domestic economy." In the specific case of Nigeria, Sala-i-Martin and Subramanian (Sala-i-Martin, Subramanian 2003) find out that, oil wealth in Nigeria has been squandered and "altered politics and governance". The authors explain that "this conjunction of a powerful political impetus to public investment and a lack of civil service skill is what makes Nigeria's economic history in this period so spectacular : almost the entire windfall was invested, and yet... there was noting to show for it".

8.3 Polarization and property rights

Consequently, when wealth and power are highly concentrated, the environment for investment is not completely certain, investors facing the risk of being held up by a powerful elite."The concentration of political and social power in the hands of a small elite implies that the majority of the population does not have secure property rights" (Acemoglu *et al* 2001) Keefer and Knack (2000) argue that social polarization reduces the security of property and contract rights. Their empirical results "provide strong support for the argument that polarization causes deterioration in the security of property rights."

9 Conclusion : poverty trap

Natural resources, when the institutional quality is weak then fuel corruption hampering the country's attractivity for foreign investors. There is thus a resource curse. Insecure property rights, rent-seeking behaviour, and corruption are likely to lead countries to a poverty trap (Zak 2002). Zak shows in his paper that "developing countries with insecure property rights may not be able to escape a poverty trap even when the government allocates an optimal amount of resources to property rights protection".

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